

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:)
)
Neil W. BOAZ *et al.*)
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Prior Application No.: 09/288,642) Group Art Unit: 1623
)
Filed: April 9, 1999) Examiner: R. DEEMIE
)
For: PREPARATION OF C₁-C₅ ALKYL)
ESTERS OF NITRO OR THIOETHER)
SUBSTITUTED AROMATIC)
CARBOXYLIC ACIDS)

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

PRELIMINARY AMENDMENT

Applicants respectfully request entry of the following amendments prior to examination of this application on the merits.

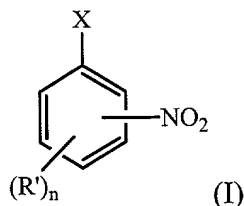
IN THE CLAIMS

Please cancel claims 1-21 and add new claims 22-35:

22. A process for the preparation of a nitro-substituted aromatic carboxylic acid ester comprising the step of:
- reacting a nitro-substituted aryl halide, in the absence of water and oxygen, with carbon monoxide and an alcohol in the presence of a metal catalyst and a proton acceptor to form a corresponding nitro-substituted aromatic carboxylic acid ester,
- wherein:
- said aryl group of said nitro-substituted aryl halide is a substituted or unsubstituted, monocyclic or polycyclic aryl group or heteroaryl group containing at least one heteroatom of N, O, or S;

said carbon monoxide is present at a pressure of 14.7- 1100 psi;
said alcohol is a linear or branched, substituted or unsubstituted C₁-C₅ alkyl alcohol;
said proton acceptor is a tertiary amine base; and
said metal catalyst is a heterogeneous catalyst of palladium metal deposited on activated carbon present in an amount of between about 1 weight percent and 500 weight percent based on said nitro-substituted aryl halide.

23. A process of claim 22, wherein said tertiary amine base is selected from the group consisting of triethylamine and tri-n-butylamine.
24. A process of claim 22, wherein
said reacting step occurs in the presence of a solvent selected from the group consisting of an excess of said alcohol, an excess of said proton acceptor, an aliphatic hydrocarbon, an aromatic hydrocarbon, a cyclic ether, an acyclic ether, a polar aprotic solvent, and mixtures thereof.
25. A process of claim 22, wherein said nitro-substituted aryl halide is of formula (I):

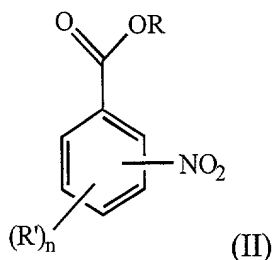


wherein

X is chloro, bromo, or iodo;

n is an integer of 1-4;

each R' is, independently, a C₁-C₁₀ alkyl group, a C₂-C₁₀ alkenyl group, a C₂-C₁₀ alkynyl group, a C₄-C₁₀ aryl or heteroaryl group, an ether, a thioether, a nitro, a trifluoromethyl, a fluoro, cyano, or acyl group; or together with the phenyl ring forms a substituted or unsubstituted fused polycyclic ring system; and
said corresponding nitro-substituted aromatic carboxylic acid ester is of formula (II):



wherein

n and R' are as defined above; and

R is a C₁-C₅ alkyl group.

26. A process of claim 25, wherein n is 1, R' is a trifluoromethyl group, and R is a methyl or n-butyl group.

27. A process of claim 26, wherein R' is para to halide X of formula (I) and the nitro group is ortho to halide X of formula (I).

28. A process for the preparation of a thioether-substituted aromatic carboxylic acid ester comprising the steps of:

preparing a nitro-substituted aromatic carboxylic acid ester according to claim 22, and
reacting the said nitro-substituted aromatic carboxylic acid ester with a thiolate anion to form the corresponding thioether-substituted aromatic carboxylic acid ester.

29. A process of claim 28, wherein said thiolate anion is prepared *in situ* from a thiol and a base, wherein

said base is selected from the group consisting of tertiary amines, alkali or alkaline earth metal hydroxides, and alkali or alkaline earth metal carbonates.

30. A process of claim 29, wherein said thiolate anion is a compound of the formula R''S⁻M⁺, wherein

R'' is a C₁-C₁₀ alkyl group or a C₄-C₁₀ aryl or heteroaryl group; and

M is selected from the group consisting of sodium, potassium and ammonium.

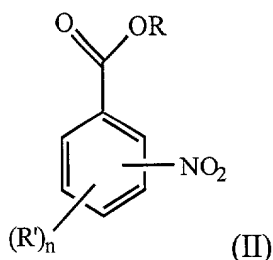
31. A process of claim 28, wherein said reacting step is conducted in a homogeneous solvent system comprising a water-miscible solvent and water, or in a phase-transfer solvent system comprising a water-immiscible organic solvent, a phase-transfer catalyst, and, optionally, water.

32. A process of claim 31, wherein said reacting step is conducted in a phase-transfer solvent system wherein

said phase-transfer catalyst is a tetralkylammonium or tetralkylphosphonium salt selected from the group consisting of tetrabutylammonium bromide, tetrabutylammonium chloride, methyltributylammonium chloride, methyl trioctylammonium chloride, and tetrabutylphosphonium bromide; and

said water-immiscible solvent is selected from the group consisting of an aliphatic hydrocarbon, an aromatic hydrocarbon, a cyclic ether, and an acyclic ether.

33. A process of claim 30, wherein said nitro-substituted aromatic carboxylic acid ester is of formula (II):



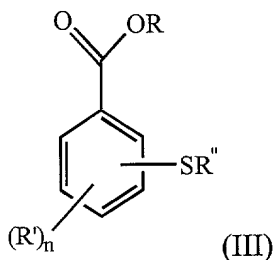
wherein

n is an integer of 1-4;

each R' is, independently, a $\text{C}_1\text{-C}_{10}$ alkyl group, a $\text{C}_2\text{-C}_{10}$ alkenyl group, a $\text{C}_2\text{-C}_{10}$ alkynyl group, a $\text{C}_4\text{-C}_{10}$ aryl or heteroaryl group, an ether, a thioether, a nitro, a trifluoromethyl, a fluoro, cyano, or acyl group; or together with the phenyl ring forms a substituted or unsubstituted fused polycyclic ring system; and

R is a $\text{C}_1\text{-C}_5$ alkyl group; and

said corresponding thioether-substituted aromatic carboxylic acid ester is of formula (III):



wherein

n, R', and R are as defined above; and

R'' is a C₁-C₁₀ alkyl group or a C₄-C₁₀ aryl or heteroaryl group.

34. A process of claim 33, wherein R' is para to the ester group of formula (II) and the nitro group is ortho to the ester group of formula (II).

35. A one-pot process for the preparation of a thioether-substituted aromatic carboxylic acid ester comprising the steps of:

reacting a nitro-substituted aryl halide, in the absence of water and oxygen, with carbon monoxide and an alcohol in the presence of a metal catalyst and a proton acceptor to form the corresponding nitro-substituted aromatic carboxylic acid ester,

wherein:

said aryl group of said nitro-substituted aryl halide is a substituted or unsubstituted, monocyclic or polycyclic aryl group or heteroaryl group containing at least one heteroatom of N, O, or S;

said carbon monoxide is present at a pressure of 14.7- 1100 psi;

said alcohol is a linear or branched, substituted or unsubstituted C₁-C₅ alkyl alcohol;

said proton acceptor is a tertiary amine base; and

said metal catalyst is a heterogeneous catalyst of palladium metal deposited on activated carbon present in an amount of between about 1 weight percent and 500 weight percent based on said nitro-substituted aryl halide, and

reacting without isolating said corresponding nitro-substituted aromatic carboxylic acid ester with a thiolate anion to form the corresponding thioether-substituted aromatic carboxylic acid ester.

REMARKS

I The Pending Claims

Claims 22-35 are pending in this application. Claims 1-21 have been canceled by this amendment. Support for claims 22-35 can be found in the original claims and throughout the specification. The claims are directed to methods using heterogeneous catalysts. Support for the new claims can be found throughout the specification as originally filed (*see* page 7, lines 1-8). Accordingly, no new matter has been introduced by this amendment.

II Conclusion

Applicants respectfully request consideration of the application in view of the above preliminary amendment and remarks.

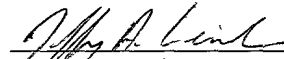
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EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account 50-0310. This paragraph is intended to be an CONSTRUCTIVE PETITION FOR EXTENSION OF TIME in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,

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By:


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Dated: December 6, 2001

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